

The following day found Prof. Wöhler unbent by the honorary burden of the 31st of July, and some privileged friends and pupils had the pleasure of seeing him working at the analysis of a new mineral with the same zeal he would have shown fifty years ago. This formed the most pleasant part of the Wöhler Festival, being a hopeful sign of the vigour and power left to this great man. The readers of NATURE (vol. xii. p. 179) were able, only a few weeks ago, by the perusal of extracts from charming recollections of Prof. Wöhler's youth, to witness a similar proof. In fact, his youth has accompanied him into his old age.

A. OPPENHEIM

THE GIGANTIC LAND TORTOISES OF THE MASCARENE AND GALAPAGOS ISLANDS*

III.

I WILL now indicate the characteristics of the different races which I have been able to recognise in the materials to which I have had access.

It has been mentioned above that the principal mark of distinction is in the form of the skull: some species having a depressed skull with the surface flat above, whilst in others it is much higher and convex above. Hand-in-hand with this difference in the skull goes another in the pelvis; the flat-headed Tortoises having a broad, horizontally dilated bridge between the obturator foramina, whilst in the round-headed form the bridge is vertically compressed. Such a distinction might have been expected between the Galapagos Tortoises on the one hand, and the Mascarene races on the other; but what justly excites our surprise is that the Galapagos Tortoises and the extinct forms of the Mascarenes belong to the same (the flat-headed) type and that, therefore, a much greater affinity exists between them, than between the extinct and living races of the Mascarenes.

I.—FLAT-HEADED TYPE

A. The *Galapagos Tortoises* may be recognised by the invariable absence of a nuchal plate, by the convergence of the posterior margins of the two gular plates which never form a straight line, by the black colour of the shell, by a large scute of the inner side of the elbow, by the double alveolar ridge of their jaws. Among the carapaces which I have examined I can distinguish five forms; of the first four severally two are more nearly related to each other than to the other pair, the fifth being intermediate between these two pairs. The degree of distinctness and affinity which obtains in the carapaces is expressed clearly and in exactly the same manner in the skulls, as will be seen from the following characteristics:—

1. In the first species (*Testudo elephantopus* of Harlan) the shell is broad and depressed, with the upper anterior profile sub-horizontal in the male, and with corrugated but not deeply sculptured plates. Sternum truncated behind. The snout is very short. Skull with an immensely developed and raised occipital crest, with a sharp outer pterygoid edge, and a deep recess in front of the occipital condyle. The skeleton of a fully adult male example and one of an immature female are in the Oxford Museum and the collection of the Royal College of Surgeons. Young individuals are by no means scarce in collections. Either this species or the next appears to have inhabited James' Island.

2. *Testudo nigrita* has likewise a broad shell which, however, is considerably higher than in the former species; the anterior profile in the male is declivous, and the plates are deeply sculptured. Sternum with a tri-

angular excision behind. The snout is longer and the occipital crest low; but the outer pterygoid edge is equally sharp, and the recess in front of the occipital condyle equally deep as in *T. elephantopus*. The principal specimens examined by myself of this species, are one 41 inches long, in the British Museum; the type of the species (described and named by Dumeril and Borbron) in the collection of the Royal College of Surgeons; and the large skull in the British Museum, figured by Dr. Gray under the name of *Testudo planiceps*.

3. Porter's account of the race inhabiting Charles Island is sufficiently characteristic to enable us to recognise it in an adult specimen, the shell of which is elongate, compressed into the form of a Spanish saddle, and of a dull colour without any polish. The sternum is truncated behind. Skull with the outer pterygoid edge flattened, with the tympanic cavity much produced backwards, and without recess in front of the occipital condyle. The only adult example which I have examined is 33 inches long, and belongs to the Museum of Science and Arts, Edinburgh. It was lent to me by the Director, Mr. T. C. Archer, who most kindly allowed the skull and limb-bones to be extracted, which could be effected without the least injury to the outward appearance of the specimen. This species I have named *Testudo ephippium*.

4. The smallest of the Galapagos Tortoises is one for which I have proposed the name *Testudo microphyes*, the carapace of a fully adult male being only 22½ inches long. We may presume that this specimen, for an examination of which I am indebted to the Museum Committee of the Royal Institution of Liverpool, is a representative of the race from Hood's Island, Porter having expressly stated that the tortoises of that island are small, and similar to those of Charles Island. Indeed, the shell is elongate as in *T. ephippium*, but the anterior profile is declivous. The skull has the characteristics of a young skull of one of its more gigantic congeners; the outer pterygoid edge is flat, and there is no recess in front of the occipital condyle, as in the species from Charles Island.

5. In the last species (*Testudo vicina*) the skull is depressed as in the first, with the upper exterior profile sub-horizontal in the male, and with the lateral anterior margins reverted so as to approach the peculiar shape of *T. ephippium*. The concentric sculpture of the plates is distinct. Sternum of quite a peculiar shape, much constricted and produced in front, and expanded and excised behind. The skull is extremely similar to that of *T. ephippium*. Unfortunately nothing is known of the history of the adult male example which formerly was in the possession of Prof. Huxley and ceded by him to the collection of the British Museum.

B. The *Mauritian Tortoises*.—It would be a matter of considerable interest to ascertain whether the tortoises of Mauritius lacked the nuchal plate, like the Galapagos races to which in other respects they are so closely related. The only carapace which I have seen is deprived of the epidermoid scutes, and, besides, so much injured in the nuchal region that it is impossible to determine the absence or presence of a nuchal plate. But the Mauritian tortoises were characterised by a peculiarity hitherto unknown among recent land tortoises, viz., by a treble serrated dental ridge along the lower jaw.

The examination of a considerable number of bones, part of which were obtained during the search for Dodo-bones, and are now in the British Museum, whilst for others from the district of Flacq I am indebted to M. Bouton, has convinced me of a multiplicity of species in this island. The majority of the bones were found near Mahebourg, in a ravine of no great depth or steepness, which apparently once conveyed to the sea the drainings of a considerable extent of circumjacent land, but which has been stopped to seaward most likely for ages by an accumulation of land. The outlet from this ravine having

* The substance of this article is contained in a paper read by the author before the Royal Society in June, 1847, and will appear in the forthcoming volume of the "Philosophical Transactions," and to which I must refer for the scientific portion and other details. Some facts which have come to my knowledge subsequently to the reading of this paper, are added. Continued from p. 265.

been thus stopped, a bog was formed called "La Mare aux Songes," with an alluvial deposit varying in depth from three to twelve feet. The tortoise bones occur at a depth of three or four feet, imbedded in a black vegetable mould; lighter coloured specimens are from the vicinity of the springs. (Zool. Trans., vi. p. 51). Among these bones I have distinguished four species, the more important characteristics of which may be particularised as follows:—

1. *Testudo triserrata*.—Proximal half of the scapula trihedral, with the anterior side convex; acromium trihedral, straight. Coracoid ankylosed to scapula at an early stage of growth. Humerus moderately slender, with the shaft flattened, and a deep hollow between the head and tuberosities. Shaft of the ulna narrow, much twisted. Ossa ilei short and broad; transverse and vertical diameters of pelvis subequal; front part of pubic bones abruptly bent downwards. Femur stout, with much dilated condyles; a deep and broad cavity between the head and trochanters.

2. *Testudo inepta*.—Proximal half of the scapula trihedral, with the anterior side concave; acromium compressed, with the end curved. Coracoid never ankylosed to the scapula. Humerus moderately slender, with the upper half of the shaft trihedral, and without hollow behind the head. Shaft of the ulna broad, not much twisted. Ossa ilei narrow and long; vertical diameter of pelvis much exceeding in length the horizontal; front part of pubic bones gently declivous. Femur stout, with much dilated condyles, and with a deep and narrow cavity between the head and trochanters.

3. *Testudo leptocnemis*, sparsely represented, with a scapular similar to that of *T. triserrata*; ossa ilei of moderate length and width, femur slender, with moderately dilated condyles, and with a deep and broad cavity between the head and trochanters.

4. *Testudo boutonii*, known from scapular and humerus only. The former bone is strongly compressed; acromium with the end curved. Coracoid not ankylosed to scapula. Humerus very stout, with the shaft trihedral in its whole length, and without hollow behind the head.

C. The *Rodriguez Tortoise*.—The remains from Rodriguez which I have hitherto examined, and for which I am indebted to M. Bouton and to the trustees of the Glasgow Museum, consist of fragments of the cranium, perfect cervical vertebrae, pelvis, and the larger leg-bones. They indicate one of the best marked species of the entire group, with a double alveolar ridge, and with the neck and limbs of greater length and slenderness than in any other species. The neural arch of the sixth nuchal vertebra is perforated by a large ovate foramen on each side close to the anterior apophyses. These perforations were closed by membrane in the living animal, and evidently caused by the pressure of the apophyses of the preceding vertebra, the animals having had the habit of bringing the neck in a vertical position, so that these two vertebrae were standing nearly at a right angle. Some of the bones are exceedingly large, larger than any of those from the Mauritius, and must have belonged to individuals of the size of our large living male from Aldabra.

II.—ROUND-HEADED TYPE: *T. indica*.

To this type belong all the specimens with a nuchal plate which have been deposited in British collections within the last forty years, or which elsewhere have been described or figured; and more especially the Tortoises from Aldabra. Whether all these specimens have come from this small group is impossible to say, as we know very little or nothing of their history. Although I have succeeded in bringing together a considerable number of specimens, from which it would appear that also in this much smaller division several races could be distinguished, I think it best to defer, for the present, the detailed publication of the results of my examination

which ere long may be supplemented or modified by important accessions.

In conclusion we may ask whether the facts which I have endeavoured to place before the readers of NATURE are more readily explained with the aid of the doctrine of a common or manifold origin of animal forms.

The naturalists who, with Darwin, maintain a common origin for allied species, however distant in their habitats, will account for the occurrence of the tortoises in the Galapagos and Mascarenes in the same way as, for instance, for the distribution of the Tapirs, viz., by the hypothesis of changes of the surface of the globe. Taking into consideration other parts of the Faunæ, they would have to assume, in this case, a former continuity of land (probably varying in extent and interrupted at various periods) between the Mascarenes and Africa, between Africa and South America, and finally between South America and the Galapagos. Indeed, the terrestrial and freshwater faunæ of Tropical America and Africa offer so many points of intimate relationship, as to support very strongly such a theory. The Tortoises, then, would be assumed to have been spread over the whole of this large area, without being able to survive long the arrival of man or large carnivorous mammals. The former, especially before he had provided himself with missile weapons, would have eagerly sought for them, as they were the easiest of his captures yielding a most plentiful supply of food; consequently they were exterminated on the continents, only some remnants being saved by having retired into places which by submergence became separated from the mainland before their enemies followed them. With this hypothesis we would be obliged to contend for this animal type an age extending over enormous periods of time, of which the period required for the loss of power of flight in the Dodo or Solitaire is but a fraction.

To my mind the advocacy of an independent origin of the same animal type, however highly organised, in different localities, seems equally justified. It has been urged that closely similar structures of the animal organism have been developed without genetic relationship; so, also, the same complex organic compound, as sugar, is produced normally by the plant and abnormally by the human organism. Without overstepping too far the limits of probability, we may assume that some Land-Tortoises were carried by stream and current from the American Continent to the Galapagos, and that others from Madagascar or Africa, found in a similar manner a new home in the Mascarene Islands. These tortoises may originally have differed from each other, like the *Testudo tabulata*, *radiata*, *sulcata* of our days, possibly not exceeding these species in size, but being placed under the same external physical conditions evidently most favourable for their further development, they assumed in course of time the same gigantic proportions and other peculiarities, the modifications in their structure which we observe now being partly genetic, partly adaptive.

Thus this curious phenomenon in the geographical distribution of animals can be explained by either of those two theories, and does not appear to me to strengthen the position of one more than that of the other. The multiplicity of the races which I have pointed out above I need not further discuss. As regards the Galapagos, this fact is quite in accordance with what has been long recognised in the distribution of the birds of the same archipelago, and the co-existence of several races in Mauritius is perfectly analogous to the variety of species of *Dinornis* in New Zealand.

ALBERT GÜNTHER

NOTES

PROF. SCHÜNFELD, of Mannheim, has been appointed successor to the late Prof. Argelander as Director of the Observatory at Bonn, and will enter upon his duties on Sept. 1. Dr.